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**Hillan**

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(54) **METHODS AND APPARATUS FOR REDUCING OVERHEAD FOR NFC DATA EXCHANGE PROTOCOL MESSAGES**

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***H04J 3/16*** (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ..... ***H04B 5/0031*** (2013.01); ***H04B 5/02*** (2013.01); ***H04L 69/22*** (2013.01); ***H04W 4/008*** (2013.01)

(58) **Field of Classification Search**
CPC .. H04B 5/02; H04B 5/0031; H04L 29/06102; H04L 2012/5652; H04L 69/22
USPC ..... 455/41.1–41.3, 558; 470/471, 474
See application file for complete search history.

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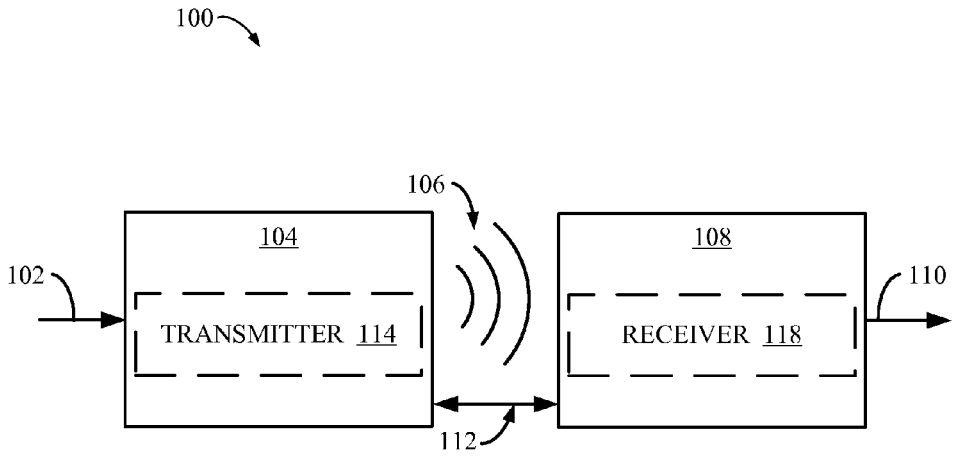
(57) **ABSTRACT**

A method, an apparatus, and a computer program product for wireless communication are provided in connection with improving NDEF message processing. In one example, a communications device is equipped to determine, based on one or more contextual factors, that data received at a NFC device is missing at least a portion of a NDEF header, and generate a complete NDEF message by adding the missing portion of the NDEF header. In another example, a communications device is equipped to receive a complete NDEF message that includes a NDEF header and data and is intended to be written on a remote NFC device, determine, based on one or more contextual factors, that the remote NFC device is configured to receive a modified version of the complete NDEF message, and generate the modified version of the complete NDEF message by removing at least a portion of the NDEF header.

**23 Claims, 8 Drawing Sheets**



(51) **Int. Cl.**

| | |
|---|---|
| ***H04J 3/22*** | (2006.01) |
| ***H04J 3/24*** | (2006.01) |
| ***H04W 4/00*** | (2009.01) |
| ***H04L 29/06*** | (2006.01) |
| ***H04B 5/02*** | (2006.01) |

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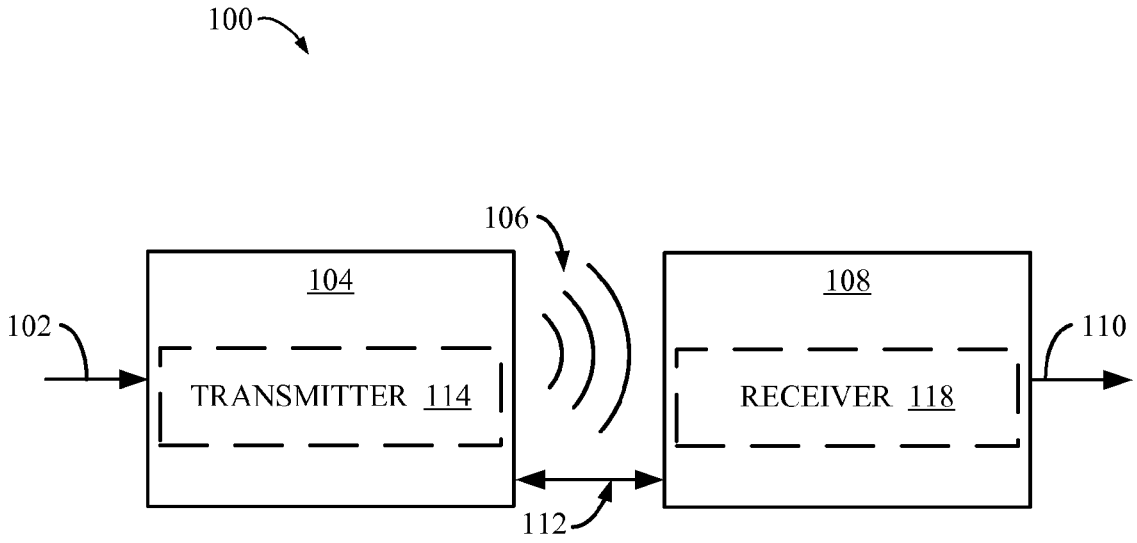


FIG. 1

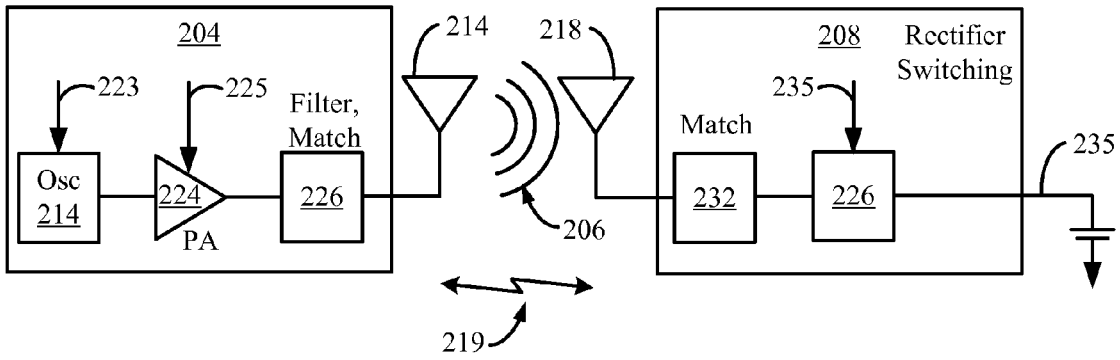
204
223
225
Filter,
Match
Osc
214
224
PA
226
214
218
206
208
Rectifier
Switching
235
Match
232
226
235
219

FIG. 2

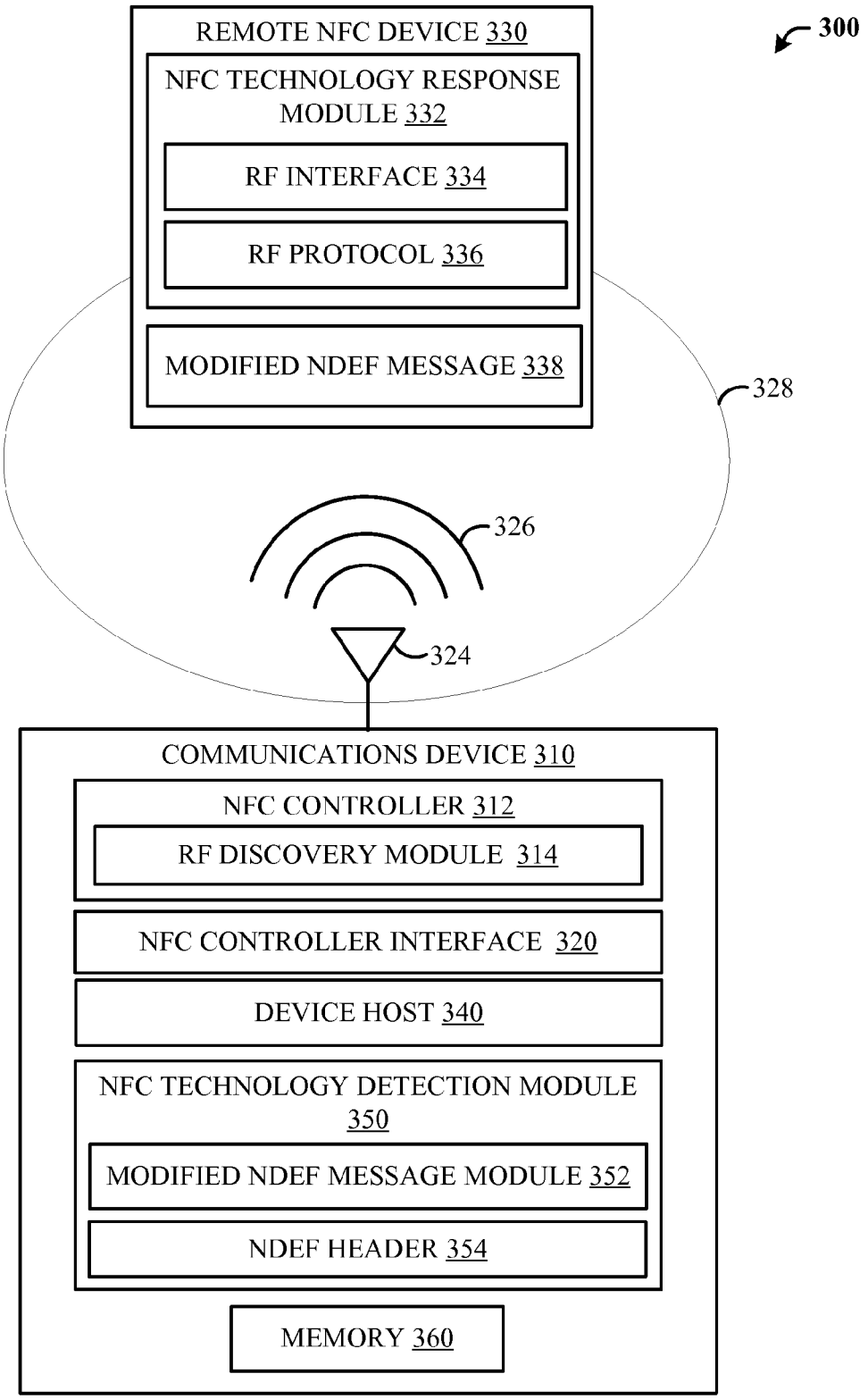
300
REMOTE NFC DEVICE 330
NFC TECHNOLOGY RESPONSE MODULE 332
RF INTERFACE 334
RF PROTOCOL 336
MODIFIED NDEF MESSAGE 338
328
326
324
COMMUNICATIONS DEVICE 310
NFC CONTROLLER 312
RF DISCOVERY MODULE 314
NFC CONTROLLER INTERFACE 320
DEVICE HOST 340
NFC TECHNOLOGY DETECTION MODULE 350
MODIFIED NDEF MESSAGE MODULE 352
NDEF HEADER 354
MEMORY 360

FIG. 3

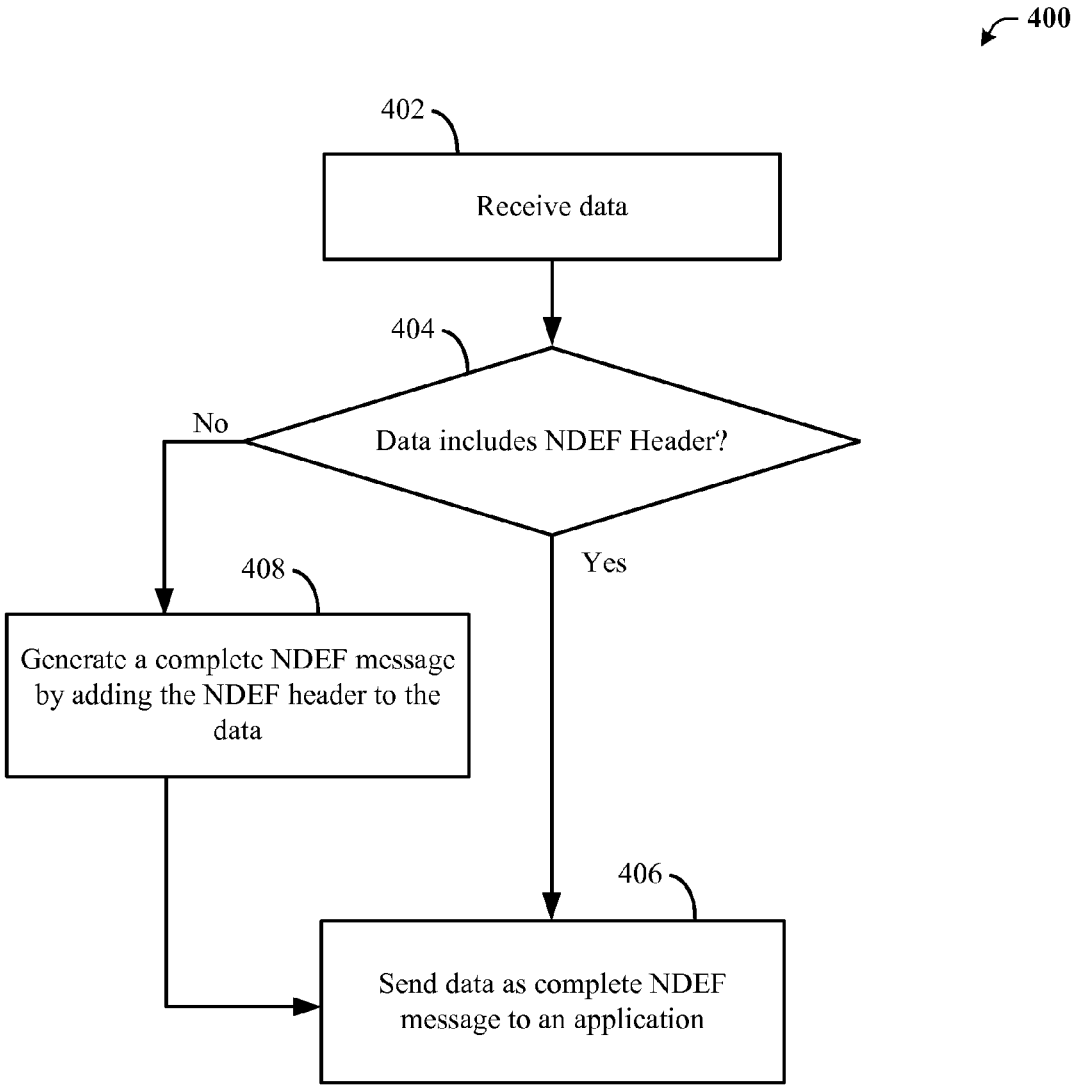
400
402
Receive data
404
Data includes NDEF Header?
No
Yes
408
Generate a complete NDEF message by adding the NDEF header to the data
406
Send data as complete NDEF message to an application

FIG. 4

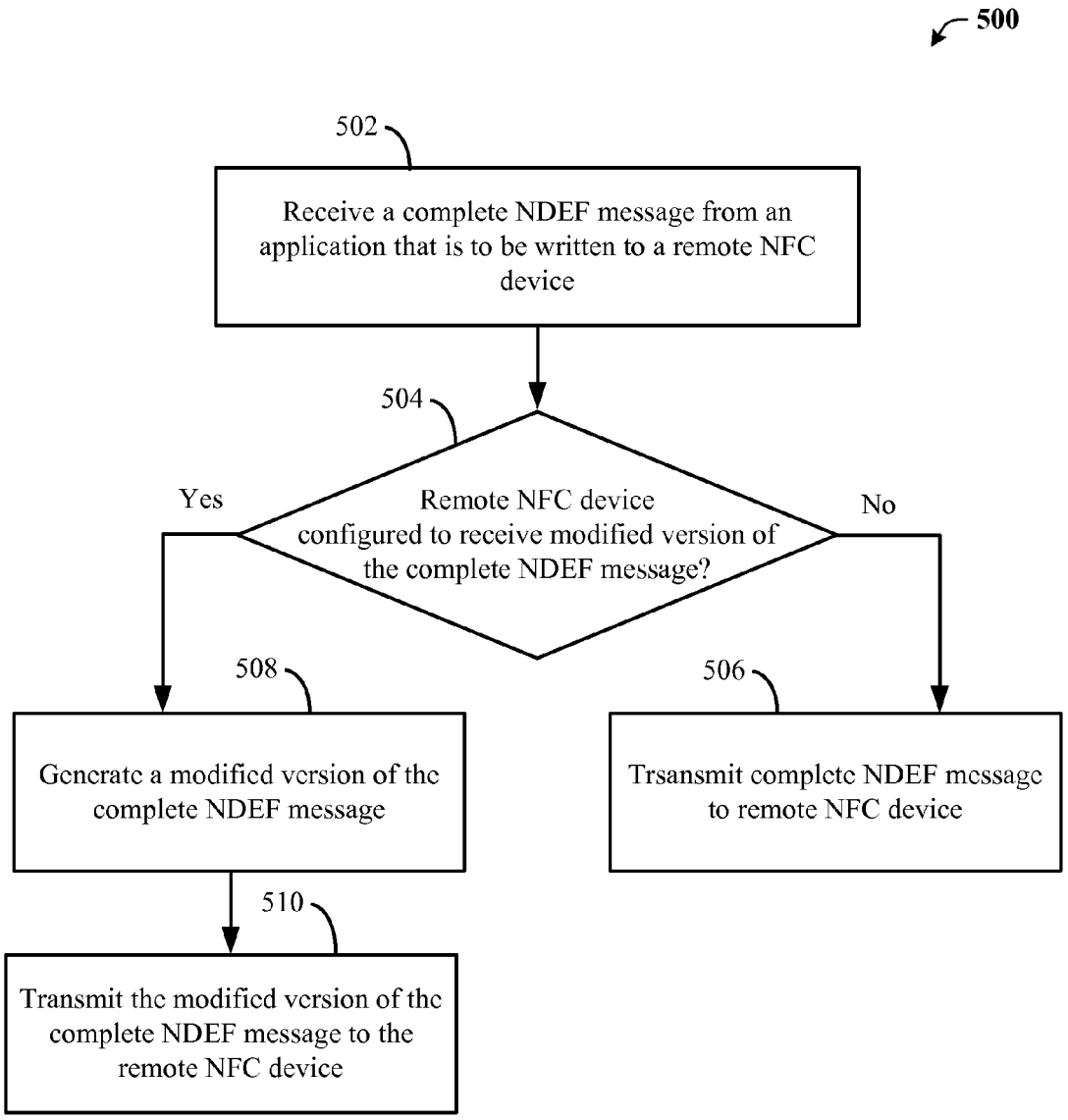
500
502
Receive a complete NDEF message from an application that is to be written to a remote NFC device
504
Remote NFC device configured to receive modified version of the complete NDEF message?
Yes
No
508
Generate a modified version of the complete NDEF message
506
Trsansmit complete NDEF message to remote NFC device
510
Transmit the modified version of the complete NDEF message to the remote NFC device

FIG. 5

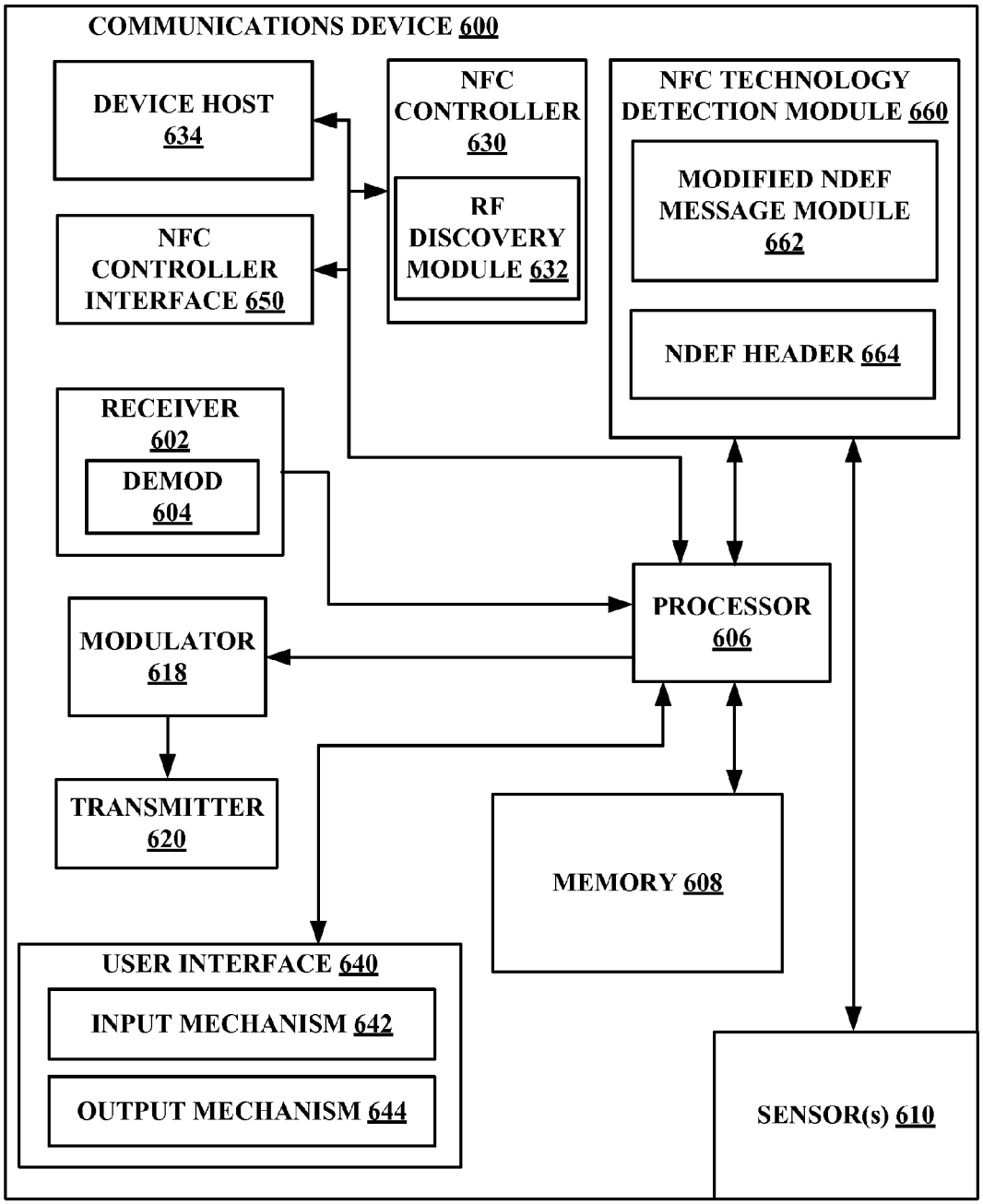
COMMUNICATIONS DEVICE 600
DEVICE HOST 634
NFC CONTROLLER 630
RF DISCOVERY MODULE 632
NFC TECHNOLOGY DETECTION MODULE 660
MODIFIED NDEF MESSAGE MODULE 662
NDEF HEADER 664
NFC CONTROLLER INTERFACE 650
RECEIVER 602
DEMOD 604
PROCESSOR 606
MODULATOR 618
TRANSMITTER 620
MEMORY 608
USER INTERFACE 640
INPUT MECHANISM 642
OUTPUT MECHANISM 644
SENSOR(s) 610

FIG. 6

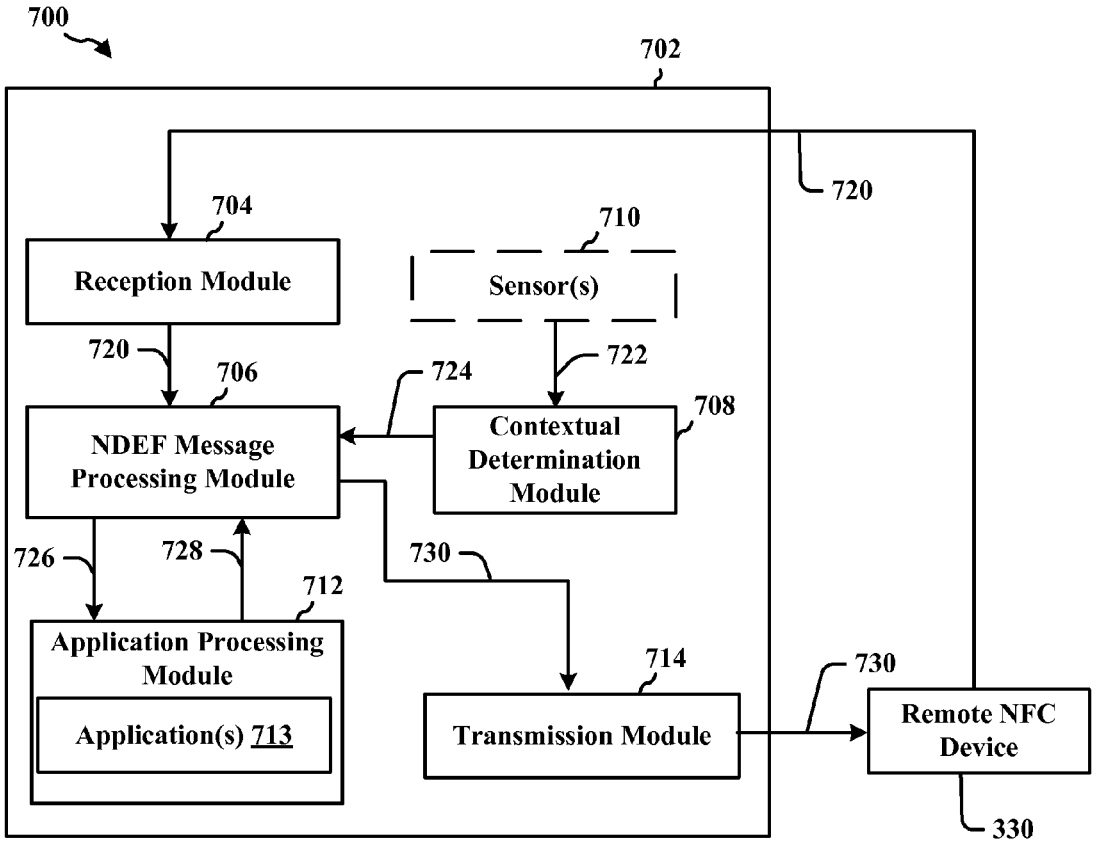
700
702
720
704
Reception Module
710
Sensor(s)
720
706
724
722
708
NDEF Message Processing Module
Contextual Determination Module
726
728
730
712
Application Processing Module
Application(s) 713
714
730
Transmission Module
Remote NFC Device
330

FIG. 7

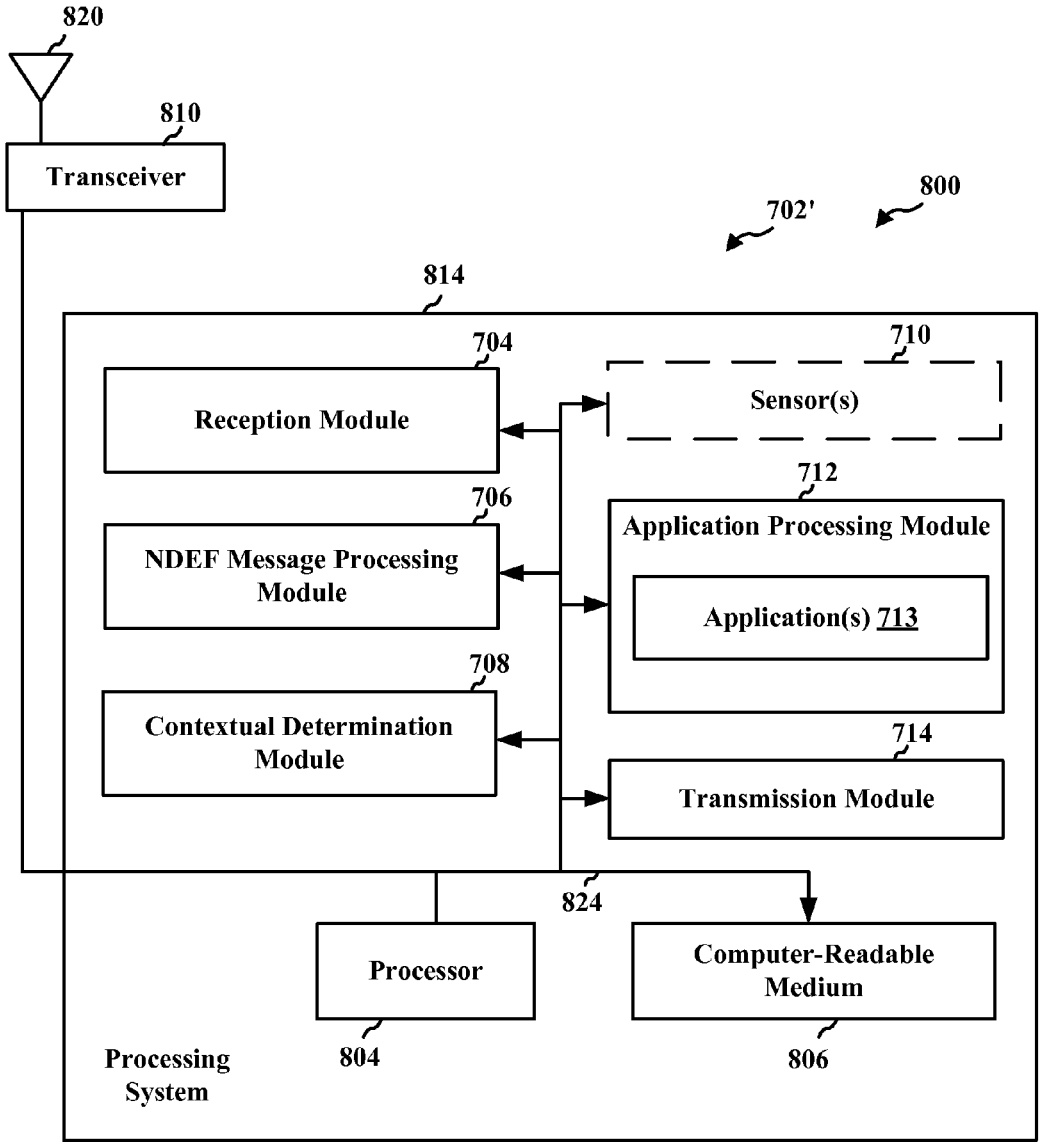
820
810
Transceiver
800
702'
814
704
Reception Module
710
Sensor(s)
712
706
NDEF Message Processing Module
Application Processing Module
Application(s) 713
708
Contextual Determination Module
714
Transmission Module
824
Processor
Computer-Readable Medium
804
806
Processing System

FIG. 8

# METHODS AND APPARATUS FOR REDUCING OVERHEAD FOR NFC DATA EXCHANGE PROTOCOL MESSAGES

## CLAIM OF PRIORITY UNDER 35 U.S.C. §119

The present Application for Patent claims priority to Provisional Application No. 61/714,939 entitled "METHODS AND APPARATUS FOR REDUCING OVERHEAD FOR NFC DATA EXCHANGE PROTOCOL MESSAGES" filed Oct. 17, 2012, and assigned to the assignee hereof and hereby expressly incorporated by reference herein.

## BACKGROUND

The disclosed aspects relate generally to communications between and/or within devices and specifically to methods and systems for reducing the overhead of near field communication (NFC) Forum NFC data exchange protocol (NDEF) messages when stored on and/or written to a remote NFC device (e.g., Tag, reader, etc.).

Advances in technology have resulted in smaller and more powerful personal computing devices. For example, there currently exist a variety of portable personal computing devices, including wireless computing devices, such as portable wireless telephones, personal digital assistants (PDAs) and paging devices that are each small, lightweight, and can be easily carried by users. More specifically, the portable wireless telephones, for example, further include cellular telephones that communicate voice and data packets over wireless networks. Many such cellular telephones are being manufactured with relatively large increases in computing capabilities, and as such, are becoming tantamount to small personal computers and hand-held PDAs. Further, such devices are being manufactured to enable communications using a variety of frequencies and applicable coverage areas, such as cellular communications, wireless local area network (WLAN) communications, near field communication (NFC), etc.

The current NFC Forum specification defines a data format (NDEF) for use during storage and retrieval of data from remote NFC devices (e.g., tags, peer devices, etc.). NDEF is currently the only NFC Forum defined way by which an NFC Forum Device can interact with other NFC devices and/or tags. As part of these interactions, a NDEF header is used. Although relatively small, the NDEF header does add overhead to the data being stored. With small/cheap tags the overhead can become a significant factor. The smaller the amount of storage available on a tag, the bigger the percentage of said storage is used for overhead. For a 64 byte tag, even a 3 byte NDEF header accounts for 5 percent of the tag storage usage. Further, for a 16 byte tag a 3 byte NDEF header accounts for approximately 20% of the tag storage usage. A smaller memory may generally use less power, and allow for faster access times, longer read/write ranges, etc.

Thus, improved apparatus and methods for reducing overhead of NDEF messages may be desired.

## SUMMARY

The following presents a simplified summary of one or more aspects in order to provide a basic understanding of such aspects. This summary is not an extensive overview of all contemplated aspects, and is intended to neither identify key or critical elements of all aspects nor delineate the scope of any or all aspects. Its sole purpose is to present some concepts of one or more aspects in a simplified form as a prelude to the more detailed description that is presented later.

In accordance with one or more aspects and corresponding disclosure thereof, various aspects are described in connection with improving NDEF message processing. In one example, a communications device is equipped to determine, based on one or more contextual factors, that data received at a NFC device is missing at least a portion of a NDEF header, and generate a complete NDEF message by adding the at least the portion of the NDEF header that is missing to the data. In another example, a communications device is equipped to receive, from a writer application, a complete NDEF message that includes a NDEF header and data and is intended to be written on a remote NFC device, determine, based on one or more contextual factors, that the remote NFC device is configured to receive a modified version of the complete NDEF message, and generate the modified version of the complete NDEF message by removing at least a portion of the NDEF header from the complete NDEF message.

According to related aspects, a method for reducing overhead of NDEF messages is provided. The method can include determining, based on one or more contextual factors, that data received at a NFC device is missing at least a portion of a NDEF header. Moreover, the method may include generating a complete NDEF message by adding the at least the portion of the NDEF header that is missing to the data.

Another aspect relates to a communications apparatus enabled to reduce overhead of NDEF messages. The communications apparatus can include means for determining, based on one or more contextual factors, that data received at a NFC device is missing at least a portion of a NDEF header. Moreover, the communications apparatus can include means for generating a complete NDEF message by adding the at least the portion of the NDEF header that is missing to the data.

Another aspect relates to a communications apparatus. The apparatus can include a transceiver configured to receive data, a memory, a NFC technology detection module coupled to at least one of the memory or the processor and configured to determine, based on one or more contextual factors, that the data received at a NFC device is missing at least a portion of a NDEF header, and generate a complete NDEF message by adding the at least the portion of the NDEF header that is missing to the data.

Still another aspect relates to a computer program product, which can have a computer-readable medium including code for determining, based on one or more contextual factors, that data received at a NFC device is missing at least a portion of a NDEF header. Moreover, the computer-readable medium can include code for generating a complete NDEF message by adding the at least the portion of the NDEF header that is missing to the data.

According to another related aspect, a method for improving NDEF message processing is provided. The method can include receiving, from a writer application, a complete NDEF message that includes a NDEF header and data and is intended to be written on a remote NFC device. Further, the method can include determining, based on one or more contextual factors, that the remote NFC device is configured to receive a modified version of the complete NDEF message. Moreover, the method may include generating the modified version of the complete NDEF message by removing at least a portion of the NDEF header from the complete NDEF message.

Another aspect relates to a communications apparatus enabled to improve NDEF message processing. The communications apparatus can include means for receiving, from a writer application, a complete NDEF message that includes a

NDEF header and data and is intended to be written on a remote NFC device. Further, the communications apparatus can include means for determining, based on one or more contextual factors, that the remote NFC device is configured to receive a modified version of the complete NDEF message. Moreover, the communications apparatus can include means for generating the modified version of the complete NDEF message by removing at least a portion of the NDEF header from the complete NDEF message.

Another aspect relates to a communications apparatus. The apparatus can include a transceiver, a memory, a processor coupled to the memory, and a NFC technology detection module coupled to at least one of the memory or the processor and configured to receive, from a writer application, a complete near field communication (NFC) data exchange format (NDEF) message that includes a NDEF header and data and is intended to be written on a remote NFC device, determine, based on one or more contextual factors, that the remote NFC device is configured to receive a modified version of the complete NDEF message, and generate the modified version of the complete NDEF message by removing at least a portion of the NDEF header from the complete NDEF message.

Still another aspect relates to a computer program product, which can have a computer-readable medium including code for receiving, from a writer application, a complete NDEF message that includes a NDEF header and data and is intended to be written on a remote NFC device. Further, the computer-readable medium may include code for determining, based on one or more contextual factors, that the remote NFC device is configured to receive a modified version of the complete NDEF message. Moreover, the computer-readable medium can include code for generating the modified version of the complete NDEF message by removing at least a portion of the NDEF header from the complete NDEF message.

To the accomplishment of the foregoing and related ends, the one or more aspects comprise the features hereinafter fully described and particularly pointed out in the claims. The following description and the annexed drawings set forth in detail certain illustrative features of the one or more aspects. These features are indicative, however, of but a few of the various ways in which the principles of various aspects may be employed, and this description is intended to include all such aspects and their equivalents.

## BRIEF DESCRIPTION OF THE DRAWINGS

The disclosed aspects will hereinafter be described in conjunction with the appended drawings, provided to illustrate and not to limit the disclosed aspects, wherein like designations denote like elements, and in which:

FIG. **1** is a block diagram of a wireless communication system, according to an aspect;

FIG. **2** is a schematic diagram of a wireless communication system, according to an aspect;

FIG. **3** is a block diagram of a NFC environment, according to an aspect;

FIG. **4** is a flowchart describing an example for processing data that lacks a NDEF header, according to an aspect;

FIG. **5** is a flowchart describing another example for processing data that lacks a NDEF header, according to an aspect;

FIG. **6** is a block diagram example architecture of a communications device, according to an aspect;

FIG. **7** is a conceptual data flow diagram illustrating the data flow between different modules/means/components in an example apparatus; and

FIG. **8** is a diagram illustrating an example of a hardware implementation for an apparatus employing a processing system.

## DETAILED DESCRIPTION

Various aspects are now described with reference to the drawings. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of one or more aspects. It may be evident, however, that such aspect(s) may be practiced without these specific details.

Generally, when communicating with a remote NFC device (e.g., tag, reader, etc.), context information may be used to infer the type of remote NFC device that is present. For example, the contextual information may include, but is not limited to location information, time or date information, RF Technology used during communications, a bit rate, an amount of data available to be communicated, analysis of a portion of the data, user interactions, etc. Accordingly, where information may be inferred about the remote NFC device, it may also be possible to omit the NDEF header from the data that is actually stored on the remote NFC device, thereby reducing overhead memory requirements on the remote NFC device. In an operational aspect, an application (e.g., reader/writer application) may still write a complete NDEF message. Thereafter, a lower layer module which, based on inferred attributes of the remote NFC device, understands the nature of the remote NFC device (e.g., tag) and/or the data may remove the NDEF header before writing. In another operational aspect, a lower layer module may add the NDEF header to the data read from a remote NFC device (e.g., tag) that has been determined to include data in a modified format (e.g., without at least a portion of the NDEF header). In such an aspect, an application may receive a complete NDEF message from the lower layer module.

FIG. **1** illustrates a wireless communication system **100**, in accordance with various exemplary embodiments of the present invention. Input power **102** is provided to a transmitter **104** for generating a radiated field **106** for providing energy transfer. A receiver **108** couples to the radiated field **106** and generates an output power **110** for storing or consumption by a device (not shown) coupled to the output power **110**. Both the transmitter **104** and the receiver **108** are separated by a distance **112**. In one exemplary embodiment, transmitter **104** and receiver **108** are configured according to a mutual resonant relationship and when the resonant frequency of receiver **108** and the resonant frequency of transmitter **104** are very close, transmission losses between the transmitter **104** and the receiver **108** are minimal when the receiver **108** is located in the "near-field" of the radiated field **106**.

Transmitter **104** further includes a transmit antenna **114** for providing a means for energy transmission and receiver **108** further includes a receive antenna **118** for providing a means for energy reception. The transmit and receive antennas are sized according to applications and devices to be associated therewith. As stated, an efficient energy transfer occurs by coupling a large portion of the energy in the near-field of the transmitting antenna to a receiving antenna rather than propagating most of the energy in an electromagnetic wave to the far field. When in this near-field a coupling mode may be developed between the transmit antenna **114** and the receive antenna **118**. The area around the antennas **114** and **118** where this near-field coupling may occur is referred to herein as a coupling-mode region.

FIG. **2** shows a simplified schematic diagram of a near field wireless communication system. The transmitter **204** includes an oscillator **222**, a power amplifier **224** and a filter and matching circuit **226**. The oscillator is configured to generate a signal at a desired frequency, which may be adjusted in response to adjustment signal **223**. The oscillator signal may be amplified by the power amplifier **224** with an amplification amount responsive to control signal **225**. The filter and matching circuit **226** may be included to filter out harmonics or other unwanted frequencies and match the impedance of the transmitter **204** to the transmit antenna **214**.

The receiver **208** may include a matching circuit **232** and a rectifier and switching circuit **234** to generate a DC power output to charge a battery **236** as shown in FIG. **2** or power a device coupled to the receiver (not shown). The matching circuit **232** may be included to match the impedance of the receiver **208** to the receive antenna **218**. The receiver **208** and transmitter **204** may communicate on a separate communication channel **219** (e.g., Bluetooth, Zigbee, cellular, etc).

With reference to FIG. **3**, a block diagram of a communication network **300** according to an aspect is illustrated. Communication network **300** may include a communications device **310** which, through antenna **324**, may be within an operating volume **328** of a remote NFC device **330**. Communications device **310** may use one or more NFC RF technologies **326** (e.g., NFC-A, NFC-B, NFC-F, etc.). In an aspect, communications device **310** may use NFC technology detection module **350** to poll the operating volume **328** to attempt to detect the presence of and identify a remote NFC device **330**. In an aspect, a remote NFC device (e.g., a tag, a reader, etc.) may be configured to communicate a data using modified NDEF message **338**. In such an aspect, the modified NDEF message **338** may include data while omitting a NDEF header. The remote NFC device may communicate the modified NDEF message using NFC technology response module **332** through one or more RF interfaces **334** using one or more RF protocols **336**. In an aspect, the remote NFC device may be configurable to use a NFC-A RF technology when transmitting the modified NDEF message. In another aspect, communications device **310** may be configurable to be connected to an access network and/or core network (e.g., a CDMA network, a GPRS network, a UMTS network, and other types of wireline and wireless communication networks). In an aspect, remote NFC device **330** may include but are not limited to a tag, a reader/writer device, a peer initiator device, a remote peer target device, etc.

Communications device **310** may include NCI **320**. In an aspect, NCI **320** may be configurable to enable communications between a device host (DH) **340** and NFC controller **312**.

Communications device **310** may include a NFC controller (NFCC) **312**. In an aspect, NFCC **312** may include RF discovery module **314**. RF discovery module **314** may be configurable to perform RF discovery using a discovery process. One aspect of the discovery process may include polling for the presence of a remote NFC device configurable to communicate using a NFC-A RF technology. DH **340** may be configurable to generate a command to prompt NFCC **312** to perform various functions associated with RF discovery.

Communications device **310** may include NFC technology detection module **350**. NFC technology detection module **350** may be configurable to detect the presence of and/or receive data from a remote NFC device **330** within the operating volume **328**. In an aspect, the remote NFC device **330** may send a modified NDEF message (e.g., data without an NDEF header). In an aspect, in which the remote NFC device **330** is a TTF device, the NFC technology detection module **350** may receive the modified NDEF message **338** upon initiation of an unmodulated RF field. NFC technology detection module **350** may further include modified NDEF message module **352** that may be configured to analyze the received modified NDEF message **338**. In an aspect, modified NDEF message module **352** may infer contextual information from various sources to assist with processing received data. In an aspect, the contextual information may be associated with remote NFC device **330**, the received data, and/or the modified NDEF message **338**. In another aspect, the modified NDEF message module **352** may obtain contextual information from one or more sensors associated with the communications device **310**. Such contextual information may include, but is not limited to, location information associated with the communications device **310**, time of day information, day of a week information, date information, NFC technology type used to obtain the data, a bit rate of the data, an amount of data available from the remote NFC device **330**, a prior communication with the remote NFC device **330**, analysis of an order of communications (e.g., which device modulated an RF field first) between the remote NFC device **330** and the communications device **310**, analysis of a portion of the data, etc. In an aspect, based at least in part of analysis of the contextual information, modified NDEF message module **352** may determine that received data is in a modified NDEF message **338** and may apply a NDEF header **354** to the modified NDEF message to generate a complete NDEF message. In such an aspect, the complete NDEF message may be communicated to an application of interest for processing. In an aspect, the NDEF header **354** may be a 3 byte header. In another aspect, where an application provides a data to be transmitted to a remote NFC device **330** in a complete NDEF message format, modified NDEF message module may determine, at least in part based on the obtained contextual information, that the remote NFC device **330** is configured to receive a modified NDEF message **338**. In such an aspect, modified NDEF message module **352** may modify the complete NDEF message by removing at least a portion of the NDEF header **354** prior to communicating the data to the remote NFC device **330**. Although FIG. **3** depicts NFC technology detection module **350** is a separate module, one of ordinary skill in the art would appreciate that the functionality associated with NFC technology detection module **350** may be included within one or more components, such as but not limited to, NFCC **312**, DH **340**, etc.

Communications device **310** may include further include memory **360** that may be configurable to store received data and/or at least a portion of a NDEF header that may be applied to a modified NDEF message to generate a complete NDEF message for processing by one or more applications associated with the communications device **310**.

Accordingly, a system and method is disclosed to reduce overhead requirements for NDEF based messaging.

FIGS. **4-5** illustrate various methodologies in accordance with various aspects of the presented subject matter. While, for purposes of simplicity of explanation, the methodologies are shown and described as a series of acts or sequence steps, it is to be understood and appreciated that the claimed subject matter is not limited by the order of acts, as some acts may occur in different orders and/or concurrently with other acts from that shown and described herein. For example, those skilled in the art will understand and appreciate that a methodology could alternatively be represented as a series of interrelated states or events, such as in a state diagram. Moreover, not all illustrated acts may be required to implement a methodology in accordance with the claimed subject matter. Additionally, it should be further appreciated that the methodolo-

gies disclosed hereinafter and throughout this specification are capable of being stored on an article of manufacture to facilitate transporting and transferring such methodologies to computers. The term article of manufacture, as used herein, is intended to encompass a computer program accessible from any computer-readable device, carrier, or media.

FIG. **4** depicts an example flowchart describing a process **400** for processing NDEF based messaging with reduced overhead.

At block **402**, a NFC device may receive data from a remote NFC device. In an aspect, the data may be received in response to a command transmitted from the NFC device. In another aspect, the data may be received from a TTF device that has responded to the presence of an unmodulated RF field. In an aspect, the data may be received from a remote NFC device that is configurable to use NFC-A radio RF technology. In another aspect, remote NFC device may include any combination of a tag, a card, and a peer device, etc.

At block **404**, the NFC device may determine whether the data includes a NDEF header (e.g., if the received data is a complete NDEF message or a modified NDEF message). In an aspect, the NFC device may make the determination based at least in part on various contextual factors. In such an aspect, the contextual factors (e.g., contextual information) may include, but is not limited to, location information associated with the NFC device, time of day information, day of a week information, date information, NFC technology type used to obtain the data, a bit rate of the data, an amount of data available from the remote NFC device, a prior communication with the remote NFC device, analysis of an order of communications (e.g., which device modulated an RF field first) between the remote NFC device and the NFC device, analysis of a portion of the data, user interaction (e.g., user opening an application), etc.

If at block **404**, the NFC device determines that the received data is formatted with a NDEF header (e.g., is a complete NDEF message), then at block **406**, the NFC device may send the complete NDEF message to one or more applications for processing.

By contrast, if at block **404**, the NFC device determines that the received data is in a modified NDEF message format (e.g., lacking at least a portion of the NDEF header), then at block **408**, the NFC device may generate a complete NDEF message by adding any omitted portion of the NDEF header to the received data. In an aspect, the NDEF header may be a 3 byte header. For example, where a tag only has sufficient storage capability to storage the data and a reference (e.g., pointer) to a NDEF header, then the NFC device may analysis the pointer any apply the referenced NDEF header to the data. In another aspect, contextual information may be used to assist the NFC device in determining which parameters to include in a generated NDEF header. Thereafter, at block **406**, the NFC device may send the complete message to one or more applications of interest.

FIG. **5** depicts an example flowchart describing another process **500** processing NDEF based messaging with reduced overhead.

At block **502**, a NFC device may receive a complete NDEF message from an application to be transmitted to a remote NFC device. In such an aspect, the complete NDEF message may include an NDEF header and data. In an aspect, remote NFC device may include any combination of a tag, a card, and a peer device, etc.

At block **504**, the NFC device may determine whether the remote NFC device is configured to receive a modified version of the complete NDEF message. In an aspect, the modified version of the NDEF message may include the data with the NDEF header omitted or in an abridged form. In an aspect, the NFC device may make the determination based at least in part on various contextual factors. In such an aspect, the contextual factors (e.g., contextual information) may include, but is not limited to, location information associated with the NFC device, time of day information, day of a week information, date information, NFC technology type used to obtain the data, a bit rate of the data, an amount of data available from the remote NFC device, a prior communication with the remote NFC device, analysis of an order of communications (e.g., which device modulated an RF field first) between the remote NFC device and the NFC device, analysis of a portion of the data, etc.

If at block **504**, the NFC device determines that the remote NFC device is not configured to receive and/or is not expecting to receive a modified version of the complete NDEF message, then at block **506**, the NFC device may transmit the complete NDEF message to the remote NFC device.

By contrast, if at block **504**, the NFC device determines that the remote NFC device is configured to receive and/or is expecting to receive a modified version of the complete NDEF message, then at block **508**, the NFC device may modify the complete NDEF message to generate the modified version of the complete NDEF message. In an aspect, the modification may include removal of at least a portion of the NDEF header.

At block **510**, the NFC device may transmit the modified version of the complete NDEF message to the remote NFC device.

While referencing FIG. **3**, but turning also now to FIG. **6**, an example architecture of communications device **600** is illustrated. As depicted in FIG. **6**, communications device **600** comprises receiver **602** that receives a signal from, for instance, a receive antenna (not shown), performs typical actions on (e.g., filters, amplifies, downconverts, etc.) the received signal, and digitizes the conditioned signal to obtain samples. Receiver **602** can comprise a demodulator **604** that can demodulate received symbols and provide them to processor **606** for channel estimation. Processor **606** can be a processor dedicated to analyzing information received by receiver **602** and/or generating information for transmission by transmitter **620**, a processor that controls one or more components of communications device **600**, and/or a processor that both analyzes information received by receiver **602**, generates information for transmission by transmitter **620**, and controls one or more components of communications device **600**. Further, signals may be prepared for transmission by transmitter **620** through modulator **618** which may modulate the signals processed by processor **606**.

Communications device **600** can additionally comprise memory **608** that is operatively coupled to various components, such as but not limited processor **606** and that can store data to be transmitted, received data, information related to available channels, TCP flows, data associated with analyzed signal and/or interference strength, information related to an assigned channel, power, rate, or the like, and any other suitable information for assisting in NFC based communications.

Further, processor **606**, device host **634**, NFCC **630**, and/or NFC technology detection module **660** can provide means for determining, based on one or more contextual factors, that data received at communications device **600** is missing at least a portion of a NDEF header **664**, and means for generating a complete NDEF message by adding the at least the portion of the NDEF header **664** that is missing to the data. In another aspect, processor **606**, device host **634**, NFCC **630**,

and/or NFC technology detection module **660** can provide means for receiving, from a writer application, a complete NDEF message that includes a NDEF header **664** and data and is intended to be written on a remote NFC device **330**, means for determining, based on one or more contextual factors, that the remote NFC device is configured to receive a modified version of the complete NDEF message, and means for generating the modified version of the complete NDEF message by removing at least a portion of the NDEF header **664** from the complete NDEF message.

It will be appreciated that data store (e.g., memory **608**) described herein can be either volatile memory or nonvolatile memory, or can include both volatile and nonvolatile memory. By way of illustration, and not limitation, nonvolatile memory can include read only memory (ROM), programmable ROM (PROM), electrically programmable ROM (EPROM), electrically erasable PROM (EEPROM), or flash memory. Volatile memory can include random access memory (RAM), which acts as external cache memory. By way of illustration and not limitation, RAM is available in many forms such as synchronous RAM (SRAM), dynamic RAM (DRAM), synchronous DRAM (SDRAM), double data rate SDRAM (DDR SDRAM), enhanced SDRAM (ESDRAM), Synchlink DRAM (SLDRAM), and direct Rambus RAM (DRRAM). Memory **608** of the subject systems and methods may comprise, without being limited to, these and any other suitable types of memory.

Communications device **600** may include a NFC controller **630** and device host **634**. In an aspect, NFCC **630** may include RF discovery module **632**. RF discovery module **632** may be configurable to perform a discovery process. One aspect of the discovery process may include polling for the presence of one or more remote NFC devices. DH **634** may be configurable to generate a command to prompt NFCC **630** to perform various functions associated with RF discovery.

In another aspect, communications device **600** may include NCI **650**. In an aspect, NCI **650** may be configurable to enable communications between a NFC controller **630** and DH **634**. NCI **650** may be configurable to function in a listening mode and/or a polling mode.

In another aspect, communications device **600** may include NFC technology detection module **660**. NFC technology detection module **660** may be configurable to detect the presence of and/or receive data from a remote NFC device within the operating volume. In an aspect, the remote NFC device may send a modified NDEF message (e.g., data without a NDEF header **664**). In an aspect, in which the remote NFC device is a TTF device, the NFC technology detection module **660** may receive the modified NDEF message upon initiation of an unmodulated RF field. NFC technology detection module **660** may further include modified NDEF message module **662** that may be configured to analyze the received modified NDEF message. In an aspect, modified NDEF message module **662** may infer contextual information from various sources to assist with processing received data. In an aspect, the contextual information may be associated with remote NFC device, the received data, and/or the modified NDEF message. In another aspect, the modified NDEF message module **662** may obtain contextual information from one or more sensors **610** associated with the communications device **600**. Such contextual information may include, but is not limited to, location information associated with the communications device **600**, time of day information, day of a week information, date information, NFC technology type used to obtain the data, a bit rate of the data, an amount of data available from the remote NFC device, a prior communication with the remote NFC device, analysis of an order of communications (e.g., which device modulated an RF field first) between the remote NFC device and the communications device **600**, analysis of a portion of the data, user interaction, etc. An example of user interaction may include where a user selects an application that is intended for the processing of TTF NFC devices. In an aspect, based at least in part of analysis of the contextual information, modified NDEF message module **662** may determine that received data is in a modified NDEF message and may apply a NDEF header **664** to the modified NDEF message to generate a complete NDEF message. In such an aspect, the complete NDEF message may be communicated to an application of interest for processing. In an aspect, the NDEF header **664** may be a **3** byte header. In another aspect, where an application provides a data to be transmitted to a remote NFC device in a complete NDEF message format, modified NDEF message module **662** may determine, at least in part based on the obtained contextual information, that the remote NFC device is configured to receive a modified NDEF message. In such an aspect, modified NDEF message module **662** may modify the complete NDEF message by removing at least a portion of the NDEF header **664** prior to communicating the data to the remote NFC device.

In another aspect, modified NDEF message module **662** may infer contextual information from various sources to assist in determining some or all of the parameters that can be included in the NDEF header **664**. For example, one parameter that may be included in a NDEF header **664** is a "Type Name" which helps an application understand what to do with a message. In an aspect, based on obtained contextual information, modified NDEF message module **662** may infer a "Type Name" to be included in a generated NDEF header **664**.

Although FIG. **6** detects NFC technology detection module **660** is a separate module, one of ordinary skill in the art would appreciate that the functionality associated with NFC technology detection module **660** may be included within one or more components, such as but not limited to, NFCC **630**, DH **634**, etc. In another aspect, NFC technology detection module **660** configurable to process NDEF based messages as described with respect to FIGS. **4-5**.

Additionally, communications device **600** may include user interface **640**. User interface **640** may include input mechanisms **642** for generating inputs into communications device **600**, and output mechanism **644** for generating information for consumption by the user of the communications device **600**. For example, input mechanism **642** may include a mechanism such as a key or keyboard, a mouse, a touchscreen display, a microphone, etc. Further, for example, output mechanism **644** may include a display, an audio speaker, a haptic feedback mechanism, a Personal Area Network (PAN) transceiver etc. In the illustrated aspects, the output mechanism **644** may include a display configurable to present media content that is in image or video format or an audio speaker to present media content that is in an audio format. In an operational aspect, output mechanism **644** may provide a user with a message and/or prompt indicating that the complete NDEF message is not supported (e.g., does not fit) on the remote NFC device, and may ask the user if he or she would like to store the data without a NDEF header

FIG. **7** is a conceptual data flow diagram **700** illustrating the data flow between different modules/means/components in an exemplary apparatus **702**. The apparatus may be a wireless device (e.g., communications device **600**, etc.). The apparatus includes a reception module **704**, a NDEF message processing module **706**, a contextual determination module **708**, an application processing module **712**, and a transmis-

sion module **714**. In an optional aspect, apparatus **702** may also include one or more sensors **710**.

In an operational aspect, apparatus **702** (e.g., communications device **600**) may receive, through reception module **704**, a NDEF message **720** from a remote NFC device **330**. Reception module **704** may relay the NDEF message **720** to NDEF message processing module **706**. NDEF message processing module **706** may also receive an indication **724** from contextual determination module **708** that the received NDEF message **720** may lack at least a portion of an NDEF header. In an aspect, contextual determination module **708** may send the indication **724** based on one or more contextual factors **722**. In such an aspect, contextual determination module **708** may receive one or more of the contextual factors **722** from one or more sensors **710**. Based on the indication **724**, NDEF message processing module **706** may add the missing NDEF header (or the portion of the NDEF header that the message is lacking) to the received NDEF message **720** to generate a complete NDEF message **726**, which may be sent to application processing module **712** and one or more applications **713**.

In another operational aspect, an application **713** (e.g., a writer application) associated with application processing module **712** may send a complete NDEF message **728**, intended for a remote NFC device **330**) to NDEF message processing module **706**. In an aspect, the complete NDEF message **728** includes a NDEF header and data. NDEF message processing module **706** may also receive an indication **724** from contextual determination module **708** that the remote NFC device **330** is configured to receive a modified version of the complete NDEF message **728**. In an aspect, contextual determination module **708** may send the indication **724** based on one or more contextual factors **722**. In such an aspect, contextual determination module **708** may receive one or more of the contextual factors **722** from one or more sensors **710**. Based on the indication **724**, NDEF message processing module **706** may modify the complete NDEF message **728** by removing the NDEF header (or a portion of the NDEF header) to generate a modified NDEF message **730**, which may be send to transmission module **714** for transmission to the remote NFC device **330**.

The apparatus may include additional modules that perform each of the steps of the algorithm in the aforementioned call flows and/or flow chart of FIGS. **4** and **5**. As such, each step in the aforementioned FIGS. **4** and **5** may be performed by a module and the apparatus may include one or more of those modules. The modules may be one or more hardware components specifically configured to carry out the stated processes/algorithm, implemented by a processor configured to perform the stated processes/algorithm, stored within a computer-readable medium for implementation by a processor, or some combination thereof.

FIG. **8** is a diagram **800** illustrating an example of a hardware implementation for an apparatus **702'** employing a processing system **814**. The processing system **814** may be implemented with a bus architecture, represented generally by the bus **824**. The bus **824** may include any number of interconnecting buses and bridges depending on the specific application of the processing system **814** and the overall design constraints. The bus **824** links together various circuits including one or more processors and/or hardware modules, represented by the processor **804**, the modules **704**, **706**, **708**, **710**, **712**, **714**, and the computer-readable medium **806**. The bus **824** may also link various other circuits such as timing sources, peripherals, voltage regulators, and power management circuits, which are well known in the art, and therefore, will not be described any further.

The processing system **814** may be coupled to a transceiver **810**. The transceiver **810** is coupled to one or more antennas **820**. The transceiver **810** provides a means for communicating with various other apparatus over a transmission medium. The processing system **814** includes a processor **804** coupled to a computer-readable medium **806**. The processor **804** is responsible for general processing, including the execution of software stored on the computer-readable medium **806**. The software, when executed by the processor **804**, causes the processing system **814** to perform the various functions described supra for any particular apparatus. The computer-readable medium **806** may also be used for storing data that is manipulated by the processor **804** when executing software. The processing system further includes at least one of the modules **704**, **706**, **708**, **710**, **712**, and **714**. The modules may be software modules running in the processor **804**, resident/stored in the computer-readable medium **806**, one or more hardware modules coupled to the processor **804**, or some combination thereof. In an aspect, the processing system **814** may be a component of the communications device **600** and may include the memory **608** and/or at least one of the processor **606**, device host **634**, NFC controller **630**, and NFC technology detection module.

In one configuration, the apparatus **702/702'** for wireless communication includes means for determining, based on one or more contextual factors, that data received at a NFC device is missing at least a portion of a NDEF header, and means for generating a complete NDEF message by adding the at least the portion of the NDEF header that is missing to the data. In an aspect, apparatus **702/702'** may further include means for receiving the data from a remote NFC device. In an aspect, apparatus **702/702'** may further include means for sending the complete NDEF message to an application.

In another configuration, the apparatus **702/702'** for wireless communication includes means for receiving, from a writer application, a complete NDEF message that includes a NDEF header and data and is intended to be written on a remote NFC device, means for determining, based on one or more contextual factors, that the remote NFC device is configured to receive a modified version of the complete NDEF message, and means for generating the modified version of the complete NDEF message by removing at least a portion of the NDEF header from the complete NDEF message. In an aspect, apparatus **702/702'** may further include means for transmitting the modified version of the complete NDEF message to the remote NFC device. In an aspect, apparatus **702/702'** means for generating may be further configured to remove at least a portion of a NDEF header from the complete NDEF message.

As described supra, the processing system **814** may include the processor **606**, device host **634**, NFC Controller **630** and/or NFC technology detection module **660**. As such, in one configuration, the aforementioned means may be the processor **606**, device host **634**, NFC Controller **630** and/or NFC technology detection module **660** configured to perform the functions recited by the aforementioned means.

As used in this application, the terms "component," "module," "system" and the like are intended to include a computer-related entity, such as but not limited to hardware, firmware, a combination of hardware and software, software, or software in execution. For example, a component may be, but is not limited to being, a process running on a processor, a processor, an object, an executable, a thread of execution, a program, and/or a computer. By way of illustration, both an application running on a computing device and the computing device can be a component. One or more components can reside within a process and/or thread of execution and a

component may be localized on one computer and/or distributed between two or more computers. In addition, these components can execute from various computer readable media having various data structures stored thereon. The components may communicate by way of local and/or remote processes such as in accordance with a signal having one or more data packets, such as data from one component interacting with another component in a local system, distributed system, and/or across a network such as the Internet with other systems by way of the signal.

Furthermore, various aspects are described herein in connection with a terminal, which can be a wired terminal or a wireless terminal. A terminal can also be called a system, device, subscriber unit, subscriber station, mobile station, mobile, mobile device, remote station, mobile equipment (ME), remote terminal, access terminal, user terminal, terminal, communication device, user agent, user device, or user equipment (UE). A wireless terminal may be a cellular telephone, a satellite phone, a cordless telephone, a Session Initiation Protocol (SIP) phone, a wireless local loop (WLL) station, a personal digital assistant (PDA), a handheld device having wireless connection capability, a computing device, or other processing devices connected to a wireless modem. Moreover, various aspects are described herein in connection with a base station. A base station may be utilized for communicating with wireless terminal(s) and may also be referred to as an access point, a Node B, or some other terminology.

Moreover, the term "or" is intended to mean an inclusive "or" rather than an exclusive "or." That is, unless specified otherwise, or clear from the context, the phrase "X employs A or B" is intended to mean any of the natural inclusive permutations. That is, the phrase "X employs A or B" is satisfied by any of the following instances: X employs A; X employs B; or X employs both A and B. In addition, the articles "a" and "an" as used in this application and the appended claims should generally be construed to mean "one or more" unless specified otherwise or clear from the context to be directed to a singular form.

The techniques described herein may be used for various wireless communication systems such as CDMA, TDMA, FDMA, OFDMA, SC-FDMA and other systems. The terms "system" and "network" are often used interchangeably. A CDMA system may implement a radio technology such as Universal Terrestrial Radio Access (UTRA), cdma2000, etc. UTRA includes Wideband-CDMA (W-CDMA) and other variants of CDMA. Further, cdma2000 covers IS-2000, IS-95 and IS-856 standards. A TDMA system may implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system may implement a radio technology such as Evolved UTRA (E-UTRA), Ultra Mobile Broadband (UMB), IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Flash-OFDMA, etc. UTRA and E-UTRA are part of Universal Mobile Telecommunication System (UMTS). 3GPP Long Term Evolution (LTE) is a release of UMTS that uses E-UTRA, which employs OFDMA on the downlink and SC-FDMA on the uplink. UTRA, E-UTRA, UMTS, LTE and GSM are described in documents from an organization named "3rd Generation Partnership Project" (3GPP). Additionally, cdma2000 and UMB are described in documents from an organization named "3rd Generation Partnership Project 2" (3GPP2). Further, such wireless communication systems may additionally include peer-to-peer (e.g., mobile-to-mobile) ad hoc network systems often using unpaired unlicensed spectrums, 802.xx wireless LAN, BLUETOOTH, near-field communications (NFC-A, NFC-B, NFC,-f, etc.), and any other short- or long-range, wireless communication techniques.

Various aspects or features will be presented in terms of systems that may include a number of devices, components, modules, and the like. It is to be understood and appreciated that the various systems may include additional devices, components, modules, etc. and/or may not include all of the devices, components, modules etc. discussed in connection with the figures. A combination of these approaches may also be used.

The various illustrative logics, logical blocks, modules, and circuits described in connection with the aspects disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general-purpose processor may be a microprocessor, but, in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration. Additionally, at least one processor may comprise one or more modules configurable to perform one or more of the steps and/or actions described above.

Further, the steps and/or actions of a method or algorithm described in connection with the aspects disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, a hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An example storage medium may be coupled to the processor, such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. Further, in some aspects, the processor and the storage medium may reside in an ASIC. Additionally, the ASIC may reside in a user terminal In the alternative, the processor and the storage medium may reside as discrete components in a user terminal. Additionally, in some aspects, the steps and/or actions of a method or algorithm may reside as one or any combination or set of codes and/or instructions on a machine readable medium and/or computer readable medium, which may be incorporated into a computer program product.

In one or more aspects, the functions described may be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, the functions may be stored or transmitted as one or more instructions or code on a computer-readable medium. Computer-readable media includes both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage medium may be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code in the form of instructions or data structures and that can be accessed by a computer. Also, any connection may be termed a computer-readable medium. For example, if software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as

infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and blu-ray disc where disks usually reproduce data magnetically, while discs usually reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media.

While the foregoing disclosure discusses illustrative aspects and/or aspects, it should be noted that various changes and modifications could be made herein without departing from the scope of the described aspects and/or aspects as defined by the appended claims. Furthermore, although elements of the described aspects and/or aspects may be described or claimed in the singular, the plural is contemplated unless limitation to the singular is explicitly stated. Additionally, all or a portion of any aspect and/or aspect may be utilized with all or a portion of any other aspect and/or aspect, unless stated otherwise.

What is claimed is:

**1**. A method of communications, comprising:
determining, based on one or more contextual factors, that data received at a near field communication (NFC) device is missing at least a portion of a NFC data exchange format (NDEF) header; and
generating a complete NDEF message by adding the at least the portion of the NDEF header that is missing to the data.

**2**. The method of claim **1**, further comprising:
receiving the data from a remote NFC device.

**3**. The method of claim **2**, wherein the remote NFC device comprises a tag, a card, or a peer device.

**4**. The method of claim **1**, further comprising:
sending the complete NDEF message to an application.

**5**. The method of claim **1**, wherein the one or more contextual factors include at least one of:
location information associated with the NFC device;
time of day information;
day of a week information;
date information;
NFC technology type used to obtain the data;
a bit rate of the data;
an amount of data available;
a prior communication with a remote NFC device;
analysis of an order of communications between the remote NFC device and the NFC device;
one or more user interactions; or
analysis of a portion of the data.

**6**. The method of claim **5**, wherein at least one parameter included in the NDEF header is determined based on the one or more contextual factors.

**7**. A non-transitory computer-readable medium comprising code for:
determining, based on one or more contextual factors, that data received at a near field communication (NFC) device is missing at least a portion of a NFC data exchange format (NDEF) header; and
generating a complete NDEF message by adding the at least the portion of the NDEF header that is missing to the data.

**8**. The non-transitory computer-readable medium of claim **7**, further comprising code for:
receiving the data from a remote NFC device.

**9**. The non-transitory computer-readable medium of claim **8**, wherein the remote NFC device comprises a tag, a card, or a peer device.

**10**. The non-transitory computer-readable medium of claim **7**, further comprising code for:
sending the complete NDEF message to an application.

**11**. The non-transitory computer-readable medium of claim **7**, wherein the one or more contextual factors include at least one of:
location information associated with the NFC device;
time of day information;
day of a week information;
date information;
NFC technology type used to obtain the data;
a bit rate of the data;
an amount of data available;
a prior communication with a remote NFC device;
analysis of an order of communications between the remote NFC device and the NFC device;
one or more user interactions; or
analysis of a portion of the data.

**12**. The non-transitory computer-readable medium of claim **11**, wherein at least one parameter included in the NDEF header is determined based on the one or more contextual factors.

**13**. An apparatus for communications, comprising:
means for determining, based on one or more contextual factors, that data received at a near field communication (NFC) device is missing at least a portion of a NFC data exchange format (NDEF) header; and
means for generating a complete NDEF message by adding the at least the portion of the NDEF header that is missing to the data.

**14**. The apparatus of claim **13**, further comprising:
means for receiving the data from a remote NFC device.

**15**. The apparatus of claim **14**, wherein the remote NFC device comprises a tag, a card, or a peer device.

**16**. The apparatus of claim **13**, further comprising:
means for sending the complete NDEF message to an application.

**17**. The apparatus of claim **13**, wherein the one or more contextual factors include at least one of:
location information associated with the NFC device;
time of day information;
day of a week information;
date information;
NFC technology type used to obtain the data;
a bit rate of the data;
an amount of data available;
a prior communication with a remote NFC device;
analysis of an order of communications between the remote NFC device and the NFC device;
one or more user interactions; or
analysis of a portion of the data.

**18**. The apparatus of claim **17**, wherein at least one parameter included in the NDEF header is determined based on the one or more contextual factors.

**19**. An apparatus for near field communication (NFC) communications, comprising:
a transceiver configured to receive data;
a memory;
a processor coupled to the memory; and
a NFC technology detection module coupled to at least one of the memory or the processor and configured to:
determine, based on one or more contextual factors, that the data received at a near field communication (NFC)

device is missing at least a portion of a NFC data exchange format (NDEF) header; and

generate a complete NDEF message by adding the at least the portion of the NDEF header that is missing to the data.

**20**. The apparatus of claim **19**, wherein the NFC technology detection module is further configured to:

send the complete NDEF message to an application.

**21**. The apparatus of claim **19**, wherein the one or more contextual factors include at least one of:

location information associated with the NFC device;

time of day information;

day of a week information;

date information;

NFC technology type used to obtain the data;

a bit rate of the data;

an amount of data available;

a prior communication with a remote NFC device;

analysis of an order of communications between the remote NFC device and the NFC device;

one or more user interactions; or

analysis of a portion of the data.

**22**. The apparatus of claim **21**, wherein at least one parameter included in the NDEF header is determined based on the one or more contextual factors.

**23**. The apparatus of claim **19**, wherein the data is received from a remote NFC device, and wherein the remote NFC device comprises a tag, a card, or a peer device.

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